103rd Street Transfer Station

Total Population in radii

0 - 1/4 = 0

1/4 - 1/2 = 0

1/2 - 1 = 3,946

1 - 2 = 131,659

2 - 3 = 240,038

3 - 4 = 406,584

total = 782,227

Chicago City.

POPULATION CALCULATION SHEET

[1] Population of City (or Other Municipality) 3,005,072 People — Year 80 — 103rd St. Transfer Station

[2] Area of City (Planimeter Reading) 228.475 Square Miles ~~Inches~~

[3] Population Density [[1] ÷ [2]] 13,152.74 People per Square Mile ~~Inch~~

[4] Average Persons per House (Census) N.A. Year ______

	1/4 mile	1/2 mile	1 mile	2 mile	3 mile	4 mile
[5] Area of City Within Radius (miles ~~Planimeter Reading~~)	0.20	0.59	2.55	10.01	18.25	30.41
[6] Population of City Within Radius [[5] x [3]]	N.A.	N.A.	*	131,658.92	240,037.51	399,974.82
[7] House Count Within Radius, Outside City	—	—	—	—	—	—
[8] Population From House Count [[7] x [4]]	—	—	—	—	—	—
[9] Total Population Within Radius [[6] + [8]]	0	0	3,945.82	131,658.92	240,037.51	399,974.82

* no residences inside 1/4 & 1/2 radii and only 0.30 sq. miles of residence in 1 mile radius

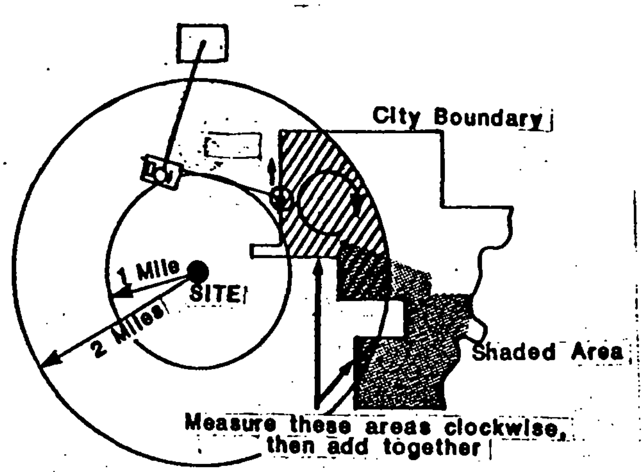
∴ 1/4 = 0
1/2 = 0
1 = 3,945.82

ERROR CHECK:

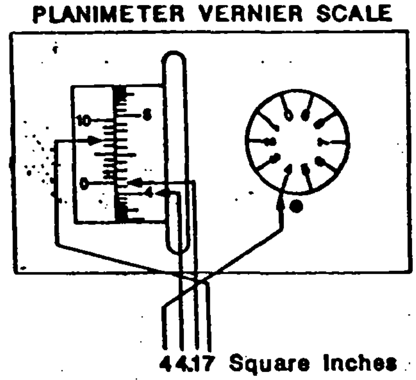
[10] Area of City Outside 4 miles ______ Square Inches

[11] Population of City Outside of 4 miles [[10] x [3]] ______ People

[12] Population of City [Σ [6] + [11]] ______ People ≟ [1]



PLANIMETER VERNIER SCALE



POPULATION CALCULATION SHEET

Hammond, IN City

103rd St Transfer Station

1 Population of City (or Other Municipality) 93,714 People Year 80

2 Area of City (Planimeter Reading) 23.8 Square ~~Inches~~ Miles

3 Population Density [1 ÷ 2] 3,937.56 People per Square ~~Inch~~ mile

4 Average Persons per House (Census) ______ Year ______

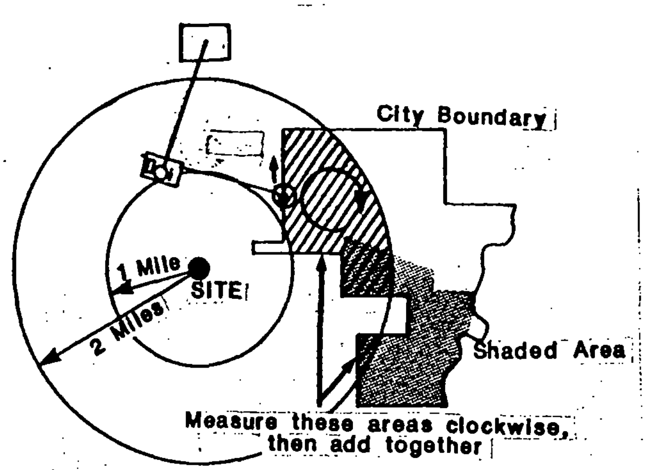
	1/4 mile	1/2 mile	1 mile	2 mile	3 mile	4 mile
5 Area of City Within Radius (~~Planimeter Reading~~ Miles)	0	0	0	0	0	1.50
6 Population of City Within Radius [5 x 3]						5,906.34
7 House Count Within Radius, Outside City						
8 Population From House Count [7 x 4]						
9 Total Population Within Radius [6 + 8]						5,906.34

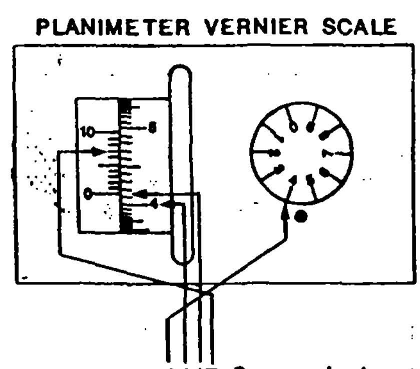
ERROR CHECK:

10 Area of City Outside 4 miles ______ Square Inches

11 Population of City Outside of 4 miles [10 x 3] ______ People

12 Population of City [$\sum$ 6 + 11] ______ People $\stackrel{?}{=}$ 1





Calumet Park, IL

POPULATION CALCULATION SHEET

103rd St Transfer Station

[1] Population of City (or Other Municipality) 8,788 People Year 80

[2] Area of City (Planimeter Reading) 1.0 Square ~~Inches~~ Miles

[3] Population Density [[1] ÷ [2]] 8,788 People per Square ~~Inch~~ Mile

[4] Average Persons per House (Census) ______ Year ______

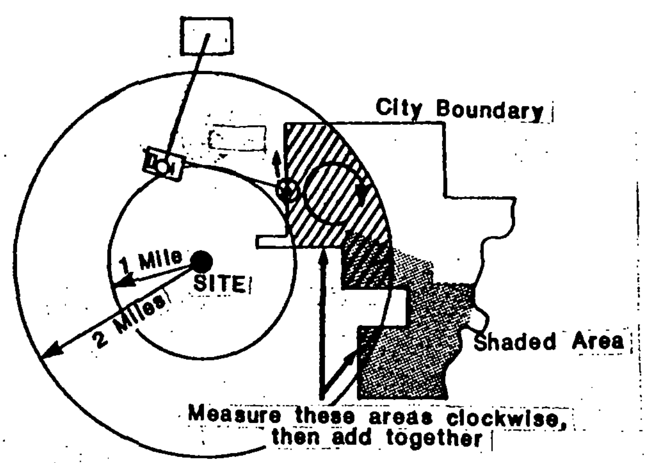
	1/4 mile	1/2 mile	1 mile	2 mile	3 mile	4 mile
[5] Area of City Within Radius ~~(Planimeter Reading)~~ Miles	0	0	0	0	0	0.08
[6] Population of City Within Radius [[5] x [3]]						703.04
[7] House Count Within Radius, Outside City						
[8] Population From House Count [[7] x [4]]						
[9] Total Population Within Radius [[6] + [8]]						703.04

ERROR CHECK:

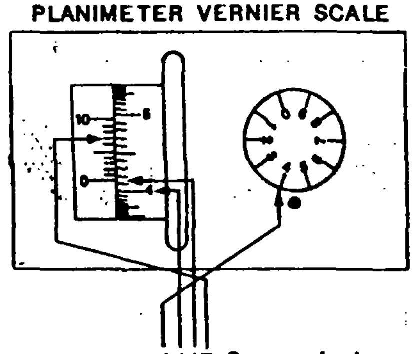
[10] Area of City Outside 4 miles ______ Square Inches

[11] Population of City Outside of 4 miles [[10] x [3]] ______ People

[12] Population of City [Σ [6] + [11]] ______ People $\stackrel{?}{=}$ [1]



PLANIMETER VERNIER SCALE



44.17 Square Inches

General Ground Water Summary

The northern area of Lake County is situated in the Calumet Lacustrine Plain. This drift consists of between 40-175ft of Wisconsin Glacio lacustrine sand and gravel in the form of long-terraced dunes, bars and beach ridges. The soil in this area is in the Oakville-Tawas association which consists of fine to medium sand with scattered deposits of organically rich Tawas silty deposits. Areas South near the Little Calumet river originate in the Valparaiso Moraine. This drift consists of sand with incontinuous deposits of silt and waterlaid clay, this clay layer is very thick in some areas. Alluvial silt is deposited in and around the Little Calumet River. As the distance South increases, the frequency of clay and silt deposits also increase. There are numerous infiltration areas also scattered throughout the area. In the Northeastern portion of Lake County, 300-625 ft of Ordovician Dolomitic limestone, sandstone and shale directly underly the surficial drift. Very few wells are drilled into this formation because of poor water quality. As the distance East increases a narrow layer of Silurian dolomitic limestone in the Wabash formation overlies the Ordovician layer, these two layers of bedrock are separated by a layer of shale. The Wabash formation is jointed and holds water , so more wells are drilled into this formation. In central and eastern Lake County a layer of Devonian Antrim and Ellsworth shale overlyies the aformentioned Silurian layer. The aquifer generally flows on a low gradient northeast toward Lake Michigan, near the Grand and Litte Calumet Rivers aquifer flow may be multidirectional depending upon seasonal differences and precipitation. The potential for ground water contamination in Northern Lake County is high for both the upper and lower aquifers due to the high permeability of the subsurface which along with the heavy precipitation causes the strong downward component to the area groundwater which could cause downward migration of contaminants to the lower aquifer before lateral movement occurs. Drinking water wells do exist in southern Gary and Black Oak. Some slightly accurate well logs and well location maps are available. A public water supply distribution map will be available by next week. This map will allow you to confirm residents that do not use ground water for drinking purposes.
(ref 2,3,4,7,8,9,)

Surface Water Information

<u>Intake Locations:</u>

All intakes are located in Lake Michigan.

Borman Park-- located due north of Madison St. approximately 1 mile offshore in 40ft of water.

Ogden Intake-- located about 12 mi. east of Borman Park intake, Between west end of Ogden Dunes and east limit of west beach.(Lattitude 87 12' 12.13" and Longitude 41 37' 56.73") approximately 1/2 mile offshore in 20 ft of water.

-Each intake has its own filtration plant and the system is blended, the Borman Park intake rate is 54 million gallons/day the Ogden intake rate is 24 million gal/day. These intakes directly serve 188,000 people. Gary, Portage, Hobart and Merrivile are directly served by these intakes(Gary-Hobart Water Co.). Gary-Hobart also sells its water wholesale to Schererville, Griffith, Ogden Dunes and City of Lake Station. Two small utilities that these intakes serve are Turkey Creek Utilities and Lincoln Gardens Utilities. (ref's 1,36)

-Hammond also has two intakes that directly serves 105,900 people. Hammond intakes also serve:

<u>city</u>	<u>pop.</u>
-Munster.............	93,714
-Highland............	23,696
-Chicago Heights....	37,200
-Lansing.............	29,039

-approximately 5,000 residents in Black Oak receive their water from Hammond

These intakes pump out approximately 50 mgd and are located to the north of Hwy. 41 near their respective aqueducts (see enclosed handout). (ref's 37-40)

-Whiting has two intakes approximately 1400-1500 ft. offshore east of filtration plant, the intakes are in about 18 feet of water.
-These intakes serve about 5,600 people
-Intakes are owned by Amaco (42)

-East Chicago has an intake east of the aqueduct, about 1.8 miles offshore, in about 28-29 ft. of water.
-This intake serves about 39,786 people. (50)

-South Chicago has four intakes (gates: rectangular, angular openings about 5 feet wide by 7 feet high) in about 23 feet of water east of 77th street about 10 feet offshore
-summer pumping rate is approximately 800 mgd
-winter pumping rate is approximately 480 mgd
-area served by this intake: south of 38th street and includes 47 suburbs
-the total population served is approximately 3.8 million people (49)

Ground water populations:
Indiana:
-**Whiting**, **Hammond** and **East Chicago** have no drinking water wells in use (ref's 1,36,38,42,44)

-Some drinking water wells do exist in the **Black Oak** section of Gary Gary-Hobart Water distribution map shows the members of the Black Oak community that are served by surface water, some residents of the area are served by Peoples Water Corp.(Hammond)---this area is bounded by 21st Street to just south of the expressway and Cline and Burr Streets.
-There are 30 residences in the area served by Peoples Water Corp still drinking ground water
-6 residences are just north of 21st Street on 20th Ave.
-12 residences are on 29th Street between Cline Street and EJ&E RR
-12 residences scattered throughout the area
-Any areas in Black Oak not served by the Gary-Hobart Water Co.(surface water distribution map is available) or in aformentioned area served by People's Water Corp. are served by ground water. (ref's 1,36,37,43)

-**Hobart:** 10 homes in southeast subdivision of Duck Creek are served by ground water wells (33)

-**Griffith:** 6 residences are served by ground water wells (scattered about and at outskirts of town) (31)

_**Highland:** Fewer than 20 residences served by ground water wells are scattered throughout the town (32)

-**Merriville:** Ground water populations exist in center and northern areas of town, some wells exist south of Route 30, subdivisions of Grassfield, Grassmeadows, and Sandpiper are served by groundwater wells (34)

-**Munster:** 10 residential wells are still in use and are scattered throughout area (35)

-**Lake Station:** 16,000 residents are served by the town's 4 municipal wells located on Union St., Vigo St., 28th Ave., and 27th Ave. Lake Station is hooked up to the Gary-Hobart system as a backup system, the area from I-65 to State St. is served by New Chicago (51)

-**Ross:** 80% of the 37,000 residents are served by the Gary-Hobart system, Eastern Ross (Colorado St. to the county line) is served by approximately 100 drinking water wells (52)

-**New Chicago:** All of the 2,581 residents are served by the Gary-Hobart Intake System (53)

-**Scherrerville:** Of the 20,000 residences ther are about 100 residences still using ground water in the central to north central area of town and the Sherland Park subdivision as well as a small subdivision off of Kennedy (67)

Illinois:

-**Alsip:** 18,200 people served by South Chicago intakes with exception of 4 buildings served by ground water wells on 127th Street between Costher and Cicero (12)

-**Blue Island:** 21,203 served by Chicago intake system, no ground water use in city (13)

-**Calumet City:** 40,000 served by surface water in Chicago, no ground water is used for drinking purposes (30)

-**Calumet Park:** Most of 8,419 residents are on surface water from Chicago, 7 residents on Vermont Street between Aberdeen and Throup Streets are using residential wells, also on ground water are two businesses, one on Ashland near 128th Street, and the other on Vermont Street north (14)

-**Crestwood:** Most of 10,823 residents recive suface water from Alsip system, 12 homes throughout community are seved by private wells (15)

-**Dixmoor:** The 3,647 residents are served by water purchased from Harvey, one well exists in local forest preserve (16)

-**Dolton:** Most of the 24,980 residents are served by surface water from Chicago, 20 homes scattered throughout city are not on the system (17)

-**Evergreen Park:** All of the 22,260 residents are sered by the Chicago intake system, the only drinking water well is at 9837 Pulaski. (18)

-**Glenwood:** Most of 9,289 residents are served by water from Chicago Heights (Hammond), some ground water is used by Cottage Grove and Lansing, Glenwood and Lansing and some on N. Main Street (19)

-**Harvey:** The majority of the 32,000 residents are served by the Chicago intake system, there are some wells in the southeast section of Harvey(South of 159th Street and East of the RR tracks---this area is gradually converting to surface water so no concrete numbers are available) (20)

-**Homewood:** Most of the 19,700 residents are served by the Chicago intake system, there are 20-25 houses on private wells of which 80% are located on 185th Street (21)

-**Lansing:** Most of the 32,000 residents are served by surface water from the Chicago intake sytem, 10 residences in the southeast end of town use well water for drinking purposesin the Peters subdivision (54)

-**Markham:** Most of the 13,136 residents are served by the Chicago surface water system, approximately 20-30 homes still use ground water for drinking although these homes are slowly converting to surface water (22)

-**Marrionette Park:** All of the 2065 residents are served by the Chicago surface water system (23)

-**Oak Forest:** All of the 26,203 residents are on the Chicago surface water system (24)

-**Oak Lawn:** All of the 60,000 residents are on Chicago surface water (25)

-**Riverdale:** All of the 13,600 residents receive their water from the Chicago Surface water system (26)

-**Robbins:** All of the 7,498 residents receive their water from the Chicago surface water system (27)

-**South Holland:** Most of the 22,105 residents are served by the Chicago intake system, 5 houses on Riverside and Penny Streets are still on ground water (28)

_**Thornton:** All of the 2,778 residents are supplied with water from South Holland noone is served by ground water (29)

Surface Water Information:

The Grand Calumet River has a hydrogeologic divide at White Oak Blvd, West of White Oak Blvd., The Grand Cal flows West; East of White Oak Blvd., the Grand Cal flows East. The Grand Calumet flows East and out the Indiana Harbor Canal, but the direction of the flow of this area of the Grand Calumet and the flow of the Indiana Harbor Canal is dependent upon water levels of Lake Michigan. The water levels of Lake Michigan can change drastically (18") in a period as short as 24 hours. The end result is that the Grand Calumet flows out of the Indiana Harbor Canal about 50% of the time. If the level of Lake Michigan is high enough all of the water can flow West past the divide and the Indiana Harbor Canal directly into the Little Calumet River. U.S. Steel dicharges 330 MGD near the mouth of the Grand Calumet, Gary Sanitary District discharges 60 MGD, and Inland Steel 390 MGD making the flow 900 cfs at some outfalls at the easternmost points of the Grand Calumet River. The east arm of the Little Calumet River, Deep River, and all of the West arm of the Little Calumet River east of Griffith discharge into Lake Michigan through the Burns Waterway. Burns Ditch is the western arm of the Little Calumet River. There is also a hydogeologic divide in the Little Calumet River depending upon the water level in Lake Michigan, the higher the water level, more water will flow West. (ref's 44-47)

Fisheries:

The West arms of the Grand and Little Calumet Rivers offer poor aquatic habitat due to heavy input from industrial and domestic pollution. Only rough fish populations exist (mostly bottom feeders such as Carp and White Suckers). Fishing has been reported along both rivers, even though warning advisories exist on amount of fish that should be consumed. Fishing occurs regularly on the beach and pier at Indiana Dunes State Park and Indiana Dunes National lakeshore. Boat fishing also occurs regularly on Lake Michigan. (ref's 4,6,8)

Lake Michigan has commercial fisheries as well as recreational fishing.
-coho and chinook salmon
-steelhead
-brown trout

-yellow perch

Direct contact with water occurs at Indiana State Park and National Lakeshore and at other municipal beaches. A portion of the beach has been closed down several times in the last two years as a result of constant water monitoring. Dunes State Park has not been shut down within the last two years due to chemical contamination. (2)

Sensitive Environments:

-Indiana Dunes State Park and National Lakeshore and forest preserves near Lake Calumet

-There are wetlands along Grand and Little Calumet Rivers, Cedar Lake, Lake George near Whiting and Hobart, and near Wolf Lake. 55% of Dunes Creek and Derby Ditch are used for park and wetlands.

-Wetlands Location maps are available for the area which encompasses all Indiana driveby PAs.

-Endangered Species in Lake Co. include the Pitchers Thistle located in Lakeshore dues and blowout areas in Lake and Porter counties. (6)

_Endangered Species in Cook Co. include the Piping Plover (lakeshore beaches), the Prarie Bush Clover and Prarie Fringed Orchid (praries), and Pergrine Falcons use areas in Cook Co. for breeding purposes (6)

Precipitation:

-Mean annual precipitation across lakeshore ranges from 36 inches in West to greater than 40 inches in the East. Maximum: April and Minnimum: February.

Flows: (average)

-Grand Calumet:	Indiana Harbor	25 cfs	
	Near US Steel	550 cfs	
-Little Calumet:	Lake George	89 cfs	
	Gary	14.6 cfs	
	South Holland	154 cfs	
-Burns Ditch:		126 cfs	(48)

FEMA floodplain maps and National Wetlands Inventory maps are available for all areas encompassing Indiana PAs.

Sewer and Storm Drain Info

Burnham: The area West of the Little Calumet has a combined sanitary and storm sewer system, The Eastern area (1/3) of the town has separate sanitary and storm sewers. There are 3 outfalls where the storm water enters the Little Calumet River, 142nd and Mackinau, Green Bay and Entry Ave, and the end of 138th Pl. (55)

Calumet City: Most of city has combined storm and sanitary system, there are 2 storm retention basins located near 142nd and Yates, from there the storm water enters the Little Cal in the vicinity of Paxton Ave. (56)

Chicago: All of the city limits have a combined storm and sanitary system, except the lakeshore where the storm sewers empty directly into Lake Michigan (58)

Dolton: East Dolton has combined sanitary and storm sewers West Dolton has separate storm and sanitary sewers. The storm sewer discharge point is the Little Calumet on Riverside Dr. between Atlantic and Princeton and there is a sewer discharge point on Sibley at Wentworth (59)

East Chicago: The majority of the city has a combined storm relief system(bypass), 2 sections of East Chicago have separate sanitary and storm sewers (Roxanne subdivision between Indianapolis Blvd. on East and White Oak on West and corporate boundry on South, and the other area is Canal St. on South and East side, Indiana Harbor Canal and George Canal on North, and the Harbor Canal on the West); the northwest outfall is located at Canal St. and Indiana Harbor Canal, an outfall at the toll road crosses the river, and two area that discharge into the East and West branch of the Grand Calumet.(64)

Glenwood: Sanitary and storm sewers are separate, Two storm sewers discharge into Count Forest Preserve on Northeast end of town, one discharges into Thorn Creek near Science Rd., one discharges into Thorn Creek just East of Arguilla Park, one discharges into Deer Creek North of Main Street. (60)

Highland: Storm drainage in Highlan is divided into 4 sections, the first outfall is located just East of Indianapolis Blvd. and the Little Calumet River, the 2nd storm takes care of parts of Kennedy Ave and parts of western subdivision, the outfall is located at Kennedy Ave and the Little Cal, the 3rd storm takes care of the majority of th city, the outfall is located at the end of 5th St., the 4th outfall is located at Grace St. and North Dr. (65)

Homewood: The storm and sanitary sewers are not connected, the storm sewers run into Butterfield Creek South of of 191st from Halsted to Kedzie, from a retention basin to the Little Calumet, storm sewers also flow along the west end of the Illinois Central train tracks then North into Hazelcrest(East of Dixie and West of Ashland) (61)

Lake Station: The city has separate storm and sanitary sewers, runnoff enters Deep River at 27th St. (51)

Lansing: Most of Lansing has separate storm and sanitary sewers with the exception of a small area in the center of town, the storm sewers lead to the Grand Calumet where there are approximately 20 outfalls, These outfalls are located around Burnham Ave, Wentworth Ave., and Bernice Ave., 10 of the 20 outfalls are located between these streets (54)

Munster: Ares of combined and separate storm and sanitary sewers exist in Munster, the storm sewers in the southwest (South of Western railroad tracks, West of Columbia) part of town discharge west into the Illinois(Lincoln and Lansing) ditch system, everything North of the Western railroad tracks and East of Columbia discharges into the Hart Ditch which in turn discharges into the Little Cal. (66)

New Chicago: The city has separate storm and sanitary sewers, the storm sewers flow into Deep River which flows into Burns Ditch, there are 4 outfalls, one at Indiana Street where it intersects Deep River, one flows West into ditch and then into Deep River at Garfield and Indiana St., one is at Iowa St. and Indiana St., one at Ohio St. where it intersects Deep River (53)

Oak Lawn: Storm and sanitary systems are separate, the storm sewers discharge into Oak Lawn Lake and Stony Creek by 110th and Cicero, and central and 105th, and also Ridgeland at 102nd. (62)

Riverdale: Riverdale has combined sanitary and storm sewers, the storm discharge points are located at Passetter, near Lake Steel, one outfall is located on the Cal Sag River between 130th near Perry St. and one outfall is located at 130th and Halsted. (63)

Scherrerville: Storm and Sanitary sewers are separate, the drainage ditch runs through Highland and runs into Hart Ditch which in turn runs into the Little Calumet River (67)

References

1) Buczek, Ken, V.P. production Gary Hobart Water Co., Contacted by Jennelle Marcereau of E & E on 5-13-91

2) Wickenshaw, Doug, Dunes State Park, contacted by Jim Broderick of E & E on 5-14-91

3) U.S. Deptment of the Interior Geological Survey of Lake Co., Bulletin 31, Plate 3, 1953

4) Clark, Douglass and Larrison, D., editors. Governor's Water Resouce Study Commission, State of Indiana, <u>The Indiana Water Resouce Availability, Uses and Needs</u>. 1980.

5) Hardy, Mark <u>Chemical and Biological Quality at the Indiana Dunes National Lakeshore, Indiana</u>, 1978-1980 Water resources Investigations 83-4802. U.S. Geological Survey Indianapolis, Indiana.

6) U.S. Department of the Interior, Fish and Wildlife Service, Endangered Species list for Region V Twin Cities, Minnesota, November 6, 1987.

7) Mitchell, M. and Perry, J. McGrain, J. <u>Indiana's Water Resources</u>, June, 1951

8) Indiana Dept. of Conservation, Investigation of Indiana,s Lakes and Streams, Indiana University Dept. of Zoology 1952.

9) Regional Planning Commission, Lake and Porter Co. <u>Water Resources Inventory</u> 1970.

10) U.S. Census Bureau, Population Survey by selected quadrants in Gary 1980.

11) Corns, Joeseph, Ecology and Environment, Site Investigation Report of Midco II NPL site. 1991.

12) Hodge, Mary Jane, Alsip Water Dept., contacted by C. Zien on 6-25-91

13) Cavallini, Loraine, Blue Island Water Dept., contacted by Chris Zien on 6-25-91

14) Gillono, Mary Ann, Calumet Park Water Dept., contacted by Chris Zien on 6-25-91

15) Benedetto, Nancy, Crestwood Water Dept., contacted by Chris Zien on 6-25-91

16) Young, Viviane, Dixmoor Water Dept., Contacted by Chris Zien on 6-25-91

17) Krass, Kathy, Dolton Water Dept. Contacted by Chris Zien on 6-25-91

18) Sherman, Pat, Evergreen Park Water Dept. contacted by Chris Zien on 6-25-91

19) Luder, Dan, Glenwood Water Dept., contacted by Chris Zien on 6-25-91

20) Gilson, Betty, Harvey Municipality, contacted by Chris Zien on 6-25-91

21) Mueller, Chris, Homewood Water Dept., contacted by Chris Zien on 6-25-91

22) Relford, William, Markham Water Dept., Contacted by Chris Zien on 6-25-91

23) Noha, Shirley, Marrionette Water Dept., contacted by Chris Zien on 6-25-91

24) Moran, Jean, Oak Forest Water Dept., contacted by Chris Zien on 6-25-91

25) Eberhardt, Phllyis, Oak Lawn Water Dept., contacted by Chris Zien on 6-25-91

26) Lebetner, Joan, Riverdale Water Dept., contacted by Chris Zien on 6-25-91

27) Beck, Ernestine, Robbins Water Dept., contacted by Chris Zien on 6-25-91

28) Deveries, Kim, South Holland Water Dept., contacted by Chris Zien on 6-25-91

29) Consorti, Margo, Thornton Water Dept., contacted by Chris Zien on 6-25-91

30) Bonic, Dennis, Calumet City Water Dept., contacted by Chris Zien on 6-25-91

31) Williams, Sara, Griffith Water Dept., contacted by Chris Zien on 6-25-91

32) Fistrovich, Dorothy, Highland Water Co., contacted by Chris Zien on 6-27-91

33) Kuchta, Margaret, Mayor of Hobart, contacted by Chris Zien on 6-27-91

34) Kosko, Janet, Merrivile Water Dept., contacted by Chris Zien on 6-27-91

35) Munster Water Dept. contacted by Chris Zien on 6-27-91

36) Jezuit, Rich, Gary-Hobart Water Corp., contacted by Chris Zien on 6-12-91

37) Musgrave, Barb, People's Water Co. Hammond, IN., contacted by Chris Zien on 6-26-91

38) Seydel, Kalee, Hammond Water Filtration Dept. contacted by Todd Ramaly on 4-8-91

39) Bonafentura, Tony, Hammond Water Works, contacted by Chris Zien on 6-24-91

40) Ortegon, Nina, Hammond Water Works, contacted by Chris Zien on 6-24-91

41) Portage Water Dept. contacted by Chris Zien on 6-27-91

42) Blahunka, Steve, Whiting Filtration Plant, contacted by Mary Tierny on 5-30-91

43) Gary-Hobart Water Co., Water Distribution Map, Areas served by intakes

44) Fenelon, Joe, U.S.G.S. Indianapolis, contacted by Donovan Robin on 6-26-91

45) Tolpa, Bob, U.S. EPA Water Division, contacted by Chris Zien on 6-26-91

46) Reshkin, Dr. Mark, Indiana Univ. Calumet Center, contacted by Chris Zien on 6-26-91

47) Vollmer, Jean Thomas J. O'Brien Lock and Dam, Contacted by Chris Zien on 6-26-91

48) U.S.G.S. Water Quality surveys for IL and IN 1991

49) Modrowski, Art, East Chicago Water Dept., Contacted by Chris Zien on 7-2-91

50) Hollod, Bill, South Chicago Filtration Plant, Contacted by Chris Zien on 6-25-91

51) Bona, Rida, Lake Station Water Dept., contacted by Chris Zien on 7-2-91

52) Delor, Greg, Ross Fire Dept., contacted by Chris Zien on 7-2-91

53) Minarich, Robert, New Chicago Water Dept., contacted by Chris Zien on 7-1-91

54) Poortenga, Al, Lansing Public Works, contacted by Chris Zien on 7-1-91

55) Korvalinka, Jim, Burnham Water Dept., contacted by Chris Zien on 6-28-91

56) Linderman, Rich, Calumet City Public Works, contacted by Chris Zien on 6-27-91

57) Talaski, Bob, Calumet Park Public Works, contacted by Chris Zien on 6-27-91

58) Rida, Hank, City of Chicago Sewer Dept., contacted by Chris Zien on 7-1-91

59) Born, Bob, Dolton Water Works, contacted by Chris Zien on 6-26-91

60) Lueder, Dan, Glenwood Public Works Dept., contacted by Chris Zien on 6-26-91

61) Foulkes, Charles, Homewood Public Works, contacted by Chris Zien on 6-26-91

62) Barrett, Phil, Oak Lawn Public Works, contacted by Chris Zien on 6-26-91

63) Calomino, Vince, Riverdale Public Works, contacted by Chris Zien on 6-27-91

64) Olson, Dan, East Chicago Sewer Dept., contacted by Chris Zien 7-2-91

65) Szubryt, Mike, Highland Sewer Dept., contacted by Chris Zien on 7-2-91

66) Mandon, Jim, Munster Sewer Dept., contacted by Chris Zien on 7-2-91

67) Norris, Beverley, Scherrerville Water Dept., contacted by Chris Zien on 7-2-91

Table 2. Land Area and Population: 1930 to 1980

[Counts relate to counties as defined at each census. For meaning of symbols, see Introduction]

Counties	1980 land area: Square miles	1980 land area: Square kilometers	Population 1980: Number	Population 1980: Per square mile	Population 1980: Per square kilometer	Percent change: 1970 to 1980	Percent change: 1960 to 1970	1970	1960	1950	1940	1930
The State	55 645	144 120	11 426 518	205.3	79.3	2.8	10.2	[1]11 110 285	10 081 158	8 712 176	7 897 241	7 630 654
Adams	852	2 206	71 622	84.1	32.5	1.1	3.5	70 861	68 467	64 690	65 229	62 784
Alexander	236	612	12 264	52.0	20.0	2.1	-25.2	12 015	16 061	20 316	25 496	22 542
Bond	377	976	16 224	43.0	16.6	15.8	-0.3	14 012	14 060	14 157	14 540	14 406
Boone	282	730	28 630	101.5	39.2	12.5	25.2	25 440	20 326	17 070	15 202	15 078
Brown	306	793	5 411	17.7	6.8	-3.1	-10.0	5 586	6 210	7 132	8 053	7 892
Bureau	869	2 251	39 114	45.0	17.4	1.5	2.5	38 541	37 594	37 711	37 600	38 845
Calhoun	250	647	5 867	23.5	9.1	3.4	-4.3	5 675	5 933	6 898	8 207	8 034
Carroll	444	1 151	18 779	42.3	16.3	-2.6	-1.2	19 276	19 507	18 976	17 987	18 433
Cass	374	969	15 084	40.3	15.6	6.1	-2.2	14 219	14 539	15 097	16 425	16 537
Champaign	998	2 585	168 392	168.7	65.1	3.1	23.3	163 281	132 436	106 100	70 578	64 273
Christian	710	1 838	36 446	51.3	19.8	1.4	-3.4	35 948	37 207	38 816	38 564	37 538
Clark	505	1 309	16 913	33.5	12.9	4.3	-2.0	16 216	16 546	17 362	18 842	17 872
Clay	469	1 215	15 283	32.6	12.6	3.7	-6.8	14 735	15 815	17 445	18 947	16 155
Clinton	472	1 223	32 617	69.1	26.7	15.2	17.8	28 315	24 029	22 594	22 912	21 369
Coles	509	1 318	52 260	102.7	39.7	9.3	11.6	47 815	42 860	40 328	38 470	37 315
Cook	958	2 481	5 253 655	5484.0	2117.6	-4.4	7.1	[1]5 493 766	5 129 725	4 508 792	4 063 342	3 982 123
Crawford	446	1 154	20 818	46.7	18.0	5.0	-4.5	19 824	20 751	21 137	21 294	21 085
Cumberland	346	896	11 062	32.0	12.3	13.2	-1.7	9 772	9 936	10 496	11 698	10 419
De Kalb	634	1 641	74 624	117.7	45.5	4.1	38.6	71 654	51 714	40 781	34 388	32 644
De Witt	397	1 027	18 108	45.6	17.6	6.7	-1.6	16 975	17 253	16 894	18 244	18 598
Douglas	417	1 080	19 774	47.4	18.3	4.1	-1.3	18 997	19 243	16 706	17 590	17 914
Du Page	337	872	658 835	1955.0	755.5	35.0	55.7	[1]487 966	313 459	154 599	103 480	91 998
Edgar	623	1 613	21 725	34.9	13.5	0.6	-4.3	21 591	22 550	23 407	24 430	24 966
Edwards	223	577	7 961	35.7	13.8	12.3	-10.7	7 090	7 940	9 056	8 974	8 303
Effingham	478	1 238	30 944	64.7	25.0	25.7	6.5	24 608	23 107	21 675	22 034	19 013
Fayette	709	1 836	22 167	31.3	12.1	6.8	-5.4	20 752	21 946	24 582	29 159	23 487
Ford	486	1 258	15 265	31.4	12.1	-6.8	-1.3	16 382	16 606	15 901	15 007	15 489
Franklin	414	1 072	43 201	104.4	40.3	12.7	-2.4	38 329	39 281	48 685	53 137	59 442
Fulton	871	2 256	43 687	50.2	19.4	4.3	-0.1	[1]41 900	41 954	43 716	44 627	43 983
Gallatin	325	841	7 590	23.4	9.0	2.3	-2.9	7 418	7 638	9 818	11 414	10 091
Greene	543	1 407	16 661	30.7	11.8	-2.1	-2.6	17 014	17 460	18 852	20 292	20 417
Grundy	423	1 095	30 582	72.3	27.9	15.3	18.7	26 535	22 350	19 217	18 398	18 678
Hamilton	436	1 129	9 172	21.0	8.1	5.9	-13.4	8 665	10 010	12 256	13 454	12 995
Hancock	795	2 060	23 877	30.0	11.6	0.9	-3.7	[1]23 664	24 574	25 790	26 297	26 420
Hardin	181	468	5 383	29.7	11.5	9.5	-16.4	4 914	5 879	7 530	7 759	6 955
Henderson	373	966	9 114	24.4	9.4	7.8	2.6	8 451	8 237	8 416	8 949	8 778
Henry	824	2 133	57 968	70.3	27.2	8.9	7.9	53 217	49 317	46 492	43 798	43 851
Iroquois	1 118	2 896	32 976	29.5	11.4	-1.7	-0.1	33 532	33 562	32 348	32 496	32 913
Jackson	590	1 528	61 522	104.3	40.3	11.8	30.5	55 008	42 151	38 124	37 920	35 680
Jasper	496	1 284	11 318	22.8	8.8	5.4	-5.3	10 741	11 346	12 266	13 431	12 809
Jefferson	570	1 476	36 552	64.1	24.8	14.8	-1.4	[1]31 848	32 315	35 892	34 375	31 034
Jersey	373	965	20 538	55.1	21.3	11.1	8.6	18 492	17 023	15 264	13 636	12 556
Jo Daviess	603	1 561	23 520	39.0	15.1	8.1	-0.3	21 766	21 821	21 459	19 989	20 235
Johnson	346	897	9 624	27.8	10.7	27.5	9.0	7 550	6 928	8 729	10 727	10 203
Kane	524	1 358	278 405	531.3	205.0	10.9	20.5	251 005	208 246	150 388	130 206	125 327
Kankakee	678	1 757	102 926	151.8	58.6	5.8	5.6	97 250	92 063	73 524	60 877	50 095
Kendall	322	835	37 202	115.5	44.6	41.1	50.4	26 374	17 540	12 115	11 105	10 555
Knox	720	1 865	61 607	85.6	33.0	1.1	-0.6	[1]60 939	61 280	54 366	52 250	51 336
Lake	454	1 177	440 372	970.0	374.1	15.1	30.3	382 638	293 656	179 097	121 094	104 387
La Salle	1 139	2 950	112 033	98.4	38.0	0.6	0.5	111 409	110 800	100 610	97 801	97 695
Lawrence	374	969	17 807	47.6	18.4	1.6	-5.5	17 522	18 540	20 539	21 075	21 885
Lee	725	1 877	36 328	50.1	19.4	-4.3	-2.1	37 947	38 749	36 451	34 604	32 329
Livingston	1 046	2 708	41 381	39.6	15.3	1.7	0.9	40 690	40 341	37 809	38 838	39 092
Logan	619	1 603	31 802	51.4	19.8	-5.2	-0.4	33 538	33 656	30 671	29 438	28 863
McDonough	590	1 528	37 467	63.5	24.5	2.2	26.7	36 653	28 928	28 199	26 944	27 329
McHenry	607	1 571	147 897	243.7	94.1	32.6	32.5	111 555	84 210	50 656	37 311	35 079
McLean	1 185	3 069	119 149	100.5	38.8	14.1	24.5	104 389	83 877	76 577	73 930	73 117
Macon	581	1 506	131 375	226.1	87.2	5.1	5.7	125 010	118 257	98 853	84 693	81 731
Macoupin	865	2 240	49 384	57.1	22.0	10.8	2.4	44 557	43 524	44 210	46 304	48 703
Madison	728	1 885	247 691	340.2	131.4	-1.3	11.7	[1]250 911	224 689	182 307	149 349	143 830
Marion	573	1 484	43 523	76.0	29.3	11.6	-0.9	38 986	39 349	41 700	47 989	35 635
Marshall	388	1 005	14 479	37.3	14.4	8.8	-0.2	13 302	13 334	13 025	13 179	13 023
Mason	536	1 389	19 492	36.4	14.0	20.5	6.5	[1]16 180	15 193	15 326	15 358	15 115
Massac	241	623	14 990	62.2	24.1	7.9	-3.2	13 889	14 341	13 594	14 937	14 081
Menard	315	817	11 700	37.1	14.3	20.8	4.7	9 685	9 248	9 639	10 663	10 575
Mercer	559	1 448	19 286	34.5	13.3	11.5	0.8	17 294	17 149	17 374	17 701	16 641
Monroe	388	1 006	20 117	51.8	20.0	6.8	21.4	18 831	15 507	13 282	12 754	12 369
Montgomery	705	1 826	31 686	44.9	17.4	4.7	-3.1	30 260	31 244	32 460	34 499	35 278
Morgan	568	1 471	37 502	66.0	25.5	3.7	-1.1	36 174	36 571	35 568	36 378	34 240
Moultrie	325	842	14 546	44.8	17.3	9.7	-2.7	13 263	13 635	13 171	13 477	13 247
Ogle	759	1 967	46 338	61.1	23.6	8.1	12.5	42 867	38 106	33 429	29 869	28 118
Peoria	620	1 607	200 466	323.3	124.7	2.6	3.3	195 318	189 044	174 347	153 374	141 344
Perry	442	1 146	21 714	49.1	18.9	9.9	3.0	19 757	19 184	21 684	23 438	22 767
Piatt	439	1 137	16 581	37.8	14.6	6.9	3.7	15 509	14 960	13 970	14 659	15 588
Pike	830	2 150	18 896	22.8	8.8	-1.5	-6.7	19 185	20 552	22 155	25 340	24 357
Pope	374	969	4 404	11.8	4.5	14.2	-5.0	3 857	4 061	5 779	7 999	7 996
Pulaski	203	526	8 840	43.5	16.8	1.1	-16.7	8 741	10 490	13 639	15 875	14 834
Putnam	160	414	6 085	38.0	14.7	21.5	9.6	5 007	4 570	4 746	5 289	5 235
Randolph	583	1 509	35 652	61.2	23.6	13.6	4.6	31 379	29 988	31 673	33 608	29 313
Richland	360	933	17 587	48.9	18.8	4.5	3.3	16 829	16 299	16 889	17 137	14 053
Rock Island	423	1 095	165 968	392.4	151.6	-0.5	10.4	166 734	150 991	133 558	113 323	98 191
St. Clair	672	1 740	267 531	398.1	153.8	-6.3	8.8	[1]285 591	262 509	205 995	166 899	157 775
Saline	385	998	28 448	73.9	28.5	10.6	-1.9	25 721	26 227	33 420	38 066	37 100
Sangamon	866	2 242	176 089	203.3	78.5	9.1	10.1	161 335	146 539	131 484	117 912	111 733
Schuyler	436	1 130	8 365	19.2	7.4	2.8	-7.0	8 135	8 746	9 613	11 430	11 676
Scott	251	649	6 142	24.5	9.5	0.8	-4.4	6 096	6 377	7 245	8 176	8 539
Shelby	747	1 935	23 923	32.0	12.4	5.9	-3.5	22 589	23 404	24 434	26 290	25 471
Stark	288	745	7 389	25.7	9.9	-1.6	-7.9	7 510	8 152	8 721	8 881	9 184
Stephenson	564	1 462	49 536	87.8	33.9	1.4	5.7	48 861	46 207	41 595	40 646	40 064
Tazewell	650	1 683	132 078	203.2	78.5	11.3	18.9	118 649	99 789	76 165	58 362	46 082
Union	414	1 073	17 765	42.9	16.6	10.5	-8.9	16 071	17 645	20 500	21 528	19 883

A COMPREHENSIVE EVALUATION OF THE OCCURRENCE, TRANSPORT, AND FATE OF GROUND WATER CONTAMINANTS IN THE LAKE CALUMET AREA OF SOUTHEAST CHICAGO

INTRODUCTION

Background

Lake Calumet is located approximately 15 miles south of downtown Chicago, Illinois and 3 miles west of the Indiana border (figure 1). The Lake Calumet area has been the site of numerous industrial enterprises, from food processing to metal refining, since about 1860 (Colten, 1985). Originally, no control was exerted over the disposal of industrial wastes generated by these facilities. Quite often, Lake Calumet and the Calumet River served as the receptors of waste discharges, particularly liquid wastes. Solid wastes, composed largely of spoil dredged from the bottom of the Calumet River and Lake Calumet, mill slag, and other industrial wastes, were dumped on unused land or used to fill low-lying areas. Hundreds of acres of land in the area were reclaimed by this method (Colten, 1985).

In more recent times, regulatory controls have attempted to curtail such indiscriminate waste disposal practices. However, a declining economy, principally in the primary metals industry, has allowed a new type of industry to flourish. Waste disposal is now the dominant land use in the Lake Calumet area. At least 31 operating or retired landfills and waste handling facilities have been documented in the Lake Calumet area (Illinois Environmental Protection Agency, 1986). The largely unregulated industrial practices of the past combined with the industrial activities of the present, although regulated, provide an uncountable number of potential environmental hazards.

Certainly, industry is not totally responsible for the decline in environmental quality. Repeated political decisions have been made to locate waste handling facilities in this area. For example, the Greater Chicago Metropolitan Sanitary District (GCMSD) alone operates several waste treatment facilities in the Lake Calumet area. These facilities include wastewater treatment and associated sludge drying operations, incineration and associated ash disposal, and large-scale landfilling operations. The decline in industrial expansion and the presence of large tracts of unused land throughout the area have increased the attractiveness of the area for waste disposal.

Until recently, the local population expressed little opposition to waste disposal practices in the Lake Calumet area. However, with the discovery of contamination in several domestic wells at homes not connected to public systems, the local citizenry has become organized to oppose the use of this area as a disposal ground for the rest of the Chicago area. They have begun to raise questions concerning the long-term health effects of the presence of the large volumes of hazardous wastes in or adjacent to their neighborhoods. Concerns have also been raised that past and present disposal practices have made the area unattractive to new industries which might consider moving into the area.

Further compounding this problem has been the inability of environmental regulations to fully protect the environment, or the health and welfare of the impacted population. For example, federal Superfund legislation emphasizes the protection of public water supplies. Because the primary source of drinking water for the Lake Calumet area is Lake Michigan, local ground-water problems do not rank high within current Superfund priorities.

Within the last five years, several studies (e.g., Colten, 1985; Illinois Environmental Protection Agency, 1986; and Ross et al., 1988) have been undertaken to improve our understanding of the threat posed by environmental stresses in the Lake Calumet area. Local citizens also have raised questions concerning the health risks posed to themselves and their families (Nelson, 1987). Many of the questions are unanswered and will remain so until more comprehensive investigations of the occurrence, fate, and transport of the environmental hazards in the Lake Calumet area can be completed.

Most recently, the Joint Committee on Hazardous Waste in the Lake Calumet Area (1987) made several recommendations designed to improve environmental conditions in the area. While the proposals are cross-cutting in their treatment of all environmental media (i.e., air, land, and water), prominent among them was the call for establishing a comprehensive ground-water monitoring network for the area. It must be recognized that ground-water monitoring, in itself, will not improve the environment. An effective monitoring program will, however, improve our understanding of the magnitude and extent of ground-water contamination so that better-informed decisions can be made concerning the proper corrective measures to implement. This proposal presents a plan to initiate a comprehensive, long-term ground-water monitoring program in the Lake Calumet area. This plan was developed by the Ground-Water Section of the Illinois State Water Survey (with support provided by the Illinois Hazardous Waste Research and Information Center, HWRIC) for consideration by the Illinois General Assembly.

Geographic Features

Lake Calumet is part of a much larger drainage system which will be described herein as the *Lake Calumet area*. In general, this area extends south from 95th Street to Sibley Boulevard and west from the Indiana state line to Martin Luther King Drive. The Calumet Expressway (I-94) passes immediately to the west of Lake Calumet; just east of the Indiana state line is the Indiana East-West Toll Road (I-90), which intercepts the Chicago Skyway at 106th Street and Lake Michigan. A large number of rail services crisscross the area including the Chicago, Rockford, and Pacific; the Illinois Central Gulf; the Penn Central; and the Norfolk and Western Railroads.

Topographically the area generally can be described as flat-lying and poorly drained. Natural, pre-landfilled, topographic relief was less than 10 feet. A unique exception to the flat topography is a knoll protruding approximately 20 feet above the general land surface just north of 95th Street. This knoll marks the location of the aptly named Stony Island, a geologic outcrop which played an important role in the formation of Lake Calumet.

The primary outlets for water from the Lake Calumet area are the Calumet, Grand Calumet, and Little Calumet rivers (figure 1). Surface drainage flows either to Lake Michigan or to the Illinois River Waterway through the Calumet Sag Channel. The O'Brien Lock and Dam located just south of Lake Calumet on the Calumet River controls the direction of flow on the river. Flow from Lake Michigan down the Calumet River and into Lake Calumet occurs when the gates at the lock and dam are open. When the gates at the lock and dam are closed, flow is from Lake Calumet toward Lake Michigan (Demissie et al., 1987).

The most recent USGS 7½' series topographic maps (photo-revised 1973) do not show the existence of, nor therefore the elevation of, the recently developed landfills. Without this information, potential changes in drainage patterns created by these man-made topographic features are largely unknown. Surface drainage patterns are further complicated by highway construction and facility storm drainage control. Drainage patterns play an important role in determining the movement of contaminants in surface runoff and in potential interaction with ground water. These patterns are presently being studied by the Surface Water Section of the Illinois State Water Survey under contract to the HWRIC.

Geology and Ground-Water Resources

The geology and ground-water hydrology of northeastern Illinois have been extensively studied and interpreted by several investigators (e.g., Suter et al., 1959; Willman, 1971; Visocky et al., 1985). Principal emphasis in recent years has been placed on declining ground-water levels in the Cambrian and Ordovician aquifers and the potential for water supply for northeastern Illinois communities (Schicht et al., 1976; Gilkeson et al., 1983; Sasman et al., 1982).

The geology of the Lake Calumet area is characterized by unconsolidated Quaternary material underlain by thick sections of sedimentary rocks. The Quaternary deposits are principally lake plain sediments, lacustrine silts and clays, and some sand and gravel. The present Lake Calumet is a remnant of a higher Lake Michigan which receded to its present position over 10,000 years ago. The prehistoric lake receded, leaving a low, flat plain of lake-bottom fine silts and clays. The rocky knoll which marks the present location of Stony Island is believed to have deflected southerly-flowing water to the east, inhibiting the deposition of coarser materials beneath the Lake Calumet location (figure 2). Sandy beach ridges along Lake Michigan situated just to the east and south of Lake Calumet are further reminders of a once larger Lake Michigan.

Many of the surficial materials adjacent to Lake Calumet now consist of various man-made materials including demolition debris (e.g., concrete rubble and stone), incinerator ash, and solid waste. Depth to bedrock in undisturbed areas is approximately 65 to 80 feet. Depth to bedrock in some filled areas may exceed 125 feet. Well records indicate that thin deposits (i.e., 5 to 10 feet) of sand and gravel occur at the bedrock surface. These unconsolidated materials do not readily yield water to wells and are not considered a viable ground-water source even for domestic supplies, which require less water than industrial supplies.

The bedrock surface in the Lake Calumet area is dolomite of Silurian age (figure 3). Most small-capacity wells in the area are completed in the dolomite at depths of 300 to 400 feet. Depending on the size and frequency of the fractures encountered, well yields in the dolomite range from 5 to 30 gallons per minute.

Beneath the dolomite lies approximately 200 feet of Maquoketa Shale. The Maquoketa Shale is the major confining unit to underlying aquifers throughout northeastern Illinois. The Maquoketa Shale separates the dolomite from the underlying Glenwood-St. Peter Sandstone and deeper formations. The Glenwood-St. Peter constitutes the principal aquifer of the region. Large-capacity wells capable of producing at rates of greater than 500 gallons per minute have been developed in the Glenwood-St. Peter-Sandstone and in underlying formations at depths of 1000 feet. According to Kirk et al. (1985),

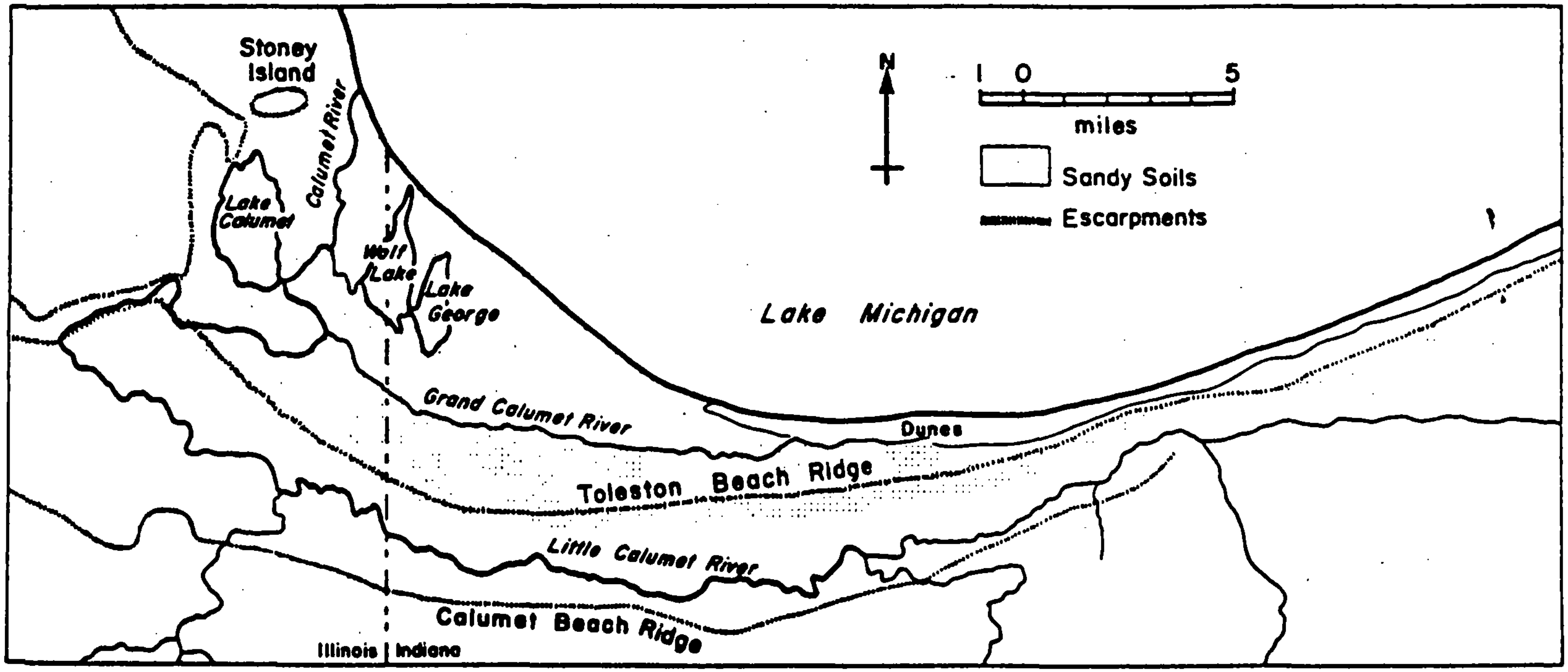


Figure 2. Calumet area topography (after Bretz, 1939)

total ground-water withdrawals in 1984 for the six townships surrounding Lake Calumet were only 244,000 gallons per day. Nearly all (more than 99 percent) of these withdrawals were due to industrial pumpage from Cambrian-Ordovician aquifers.

Because of the low elevation of the Lake Calumet area, the water table is very near the land surface. In general, the water table elevation can be readily observed by surface water elevations in Lake Calumet and surrounding ditches. Ground-water elevations in the dolomite wells range from 20 to 40 feet below ground surface, indicating an overall downward movement of shallow ground water to recharge the underlying bedrock. No studies have been conducted to map the direction of shallow ground-water movement near Lake Calumet or the amount of ground-water discharge into the lake. Similarly, no studies have evaluated the impact of local ground-water discharge on near-shore Lake Michigan water quality. This study will accomplish these goals.

1991 Indiana Fish Consumption Advisories

River, Stream or Lake	Fish Species Involved	Scope of Advisory
Clear Creek in Monroe Co.	All	2
Pleasant Run Creek and Salt Creek downstream of Monroe Reservoir Dam in Monroe and Lawrence Counties	All	3
Elliott Ditch and Wea Creek from its confluence with Elliott Ditch in Tippecanoe County	All	3
East Fork of White River from Bedford to Williams Dam	All	3
East Fork of White River below Williams Dam in Lawrence Co.	Carp	2
White River in Delaware Co. downstream from the Yorktown Bridge (C.R. 575W)	Carp	2
West Fork of White River from Noblesville to Hamilton/Marion County line	All	2
Stoney Creek downstream from Wilson Ditch south of Noblesville	All	3
Little Mississinewa River in Randolph County	All	3
Mississinewa River from one mile above the confluence of Little Mississinewa River and downstream to Ridgeville	Carp Catfish	3 3
St. Joseph River in St. Joseph and Elkhart Counties	Carp	2
Maumee River below Ft. Wayne to state line	Carp	2
Sand Creek and Muddy Fork of Sand Creek near Greensburg and Decatur County Reservoir	All	2
Grand Calumet River, East and West branches, and the Indiana Harbor Ship Canal in Lake Co.	All	3
Wildcat Creek downstream of the Waterworks Dam in Kokomo to the Wabash River	All	3
Kokomo Creek in Howard Co. from U.S. 31 to Wildcat Creek	All	3
Little Sugar Creek in Montgomery Co.	All	3
Sugar Creek in Montgomery County south of I-74 to S.R. 32 bridge	All	3

Lake Michigan and Tributaries Fish Advisory

Species	Advisory
Brown Trout under 23"	Group 2
Brown Trout over 23"	Group 3
Carp	Group 3
Catfish	Group 3
Chinook 21-32"	Group 2
Chinook over 32"	Group 3
Coho over 26"	Group 2
Lake Trout 20 - 23"	Group 2
Lake Trout over 23"	Group 3

Ohio River Fish Advisory

Species	Advisory
Carp	Group 2
Channel Catfish under 19"	Group 2
Channel Catfish over 19"	Group 3

Advisories fall in three categories. A Group 3 advisory indicates that no one should eat designated species from named waterways. A Group 2 advisory means that adult men and women not of child-bearing age should consume no more than 1 meal per week consisting of up to one-half pound of flesh of designated species from named waterways. Women of child-bearing age and children under the age of 18 should not consume any of the fish listed in Group 2. Undesignated species in named waterways and all waterways not listed on the advisory receive a Group 1 rating, which means no consumption advisory is in effect.

1990 Sport Fish Health Advisories for Illinois Waters

Organochlorine Contamination in Fish

Water Body	Level of Contaminants Group 1-Low	Group 2-Moderate	Group 3-High
Lake Michigan	Lake trout up to 20" Coho salmon up to 26" Chinook salmon up to 21" Brook trout Rainbow trout Pink salmon Smelt Perch	Lake trout 20-23" Coho salmon over 26" Chinook salmon 21-32" Brown trout up to 23"	Lake trout over 23" Chinook salmon over 32" Brown trout over 23" Carp Catfish
Lake Springfield	White crappie Carp under 26" Flathead catfish under 16" Largemouth Bass	Bigmouth buffalo	Channel catfish Carp over 26" Flathead catfish over 16"
Lake Decatur		Channel catfish	Flathead catfish Bigmouth buffalo
Lake Taylorville		Carp	Channel catfish Bigmouth buffalo
Clinton Lake		Channel catfish	
Lake Bracken		Largemouth bass Bluegill Crappie	Carp Channel catfish
Crab Orchard Lake (west of Route 148)	Bullheads White crappie Largemouth bass Bluegill Channel catfish	Carp	
Crab Orchard Lake (east of Route 148)	Bullheads White crappie Bluegill Largemouth bass	Channel catfish Carp under 15"	Carp over 15"
DesPlaines River from Lockport to Kankakee River Confluence		Channel catfish Smallmouth buffalo Drum	Carp
Illinois River headwater to Starved Rock Dam			Carp
Mississippi River Des Moines River Confluence to Lock and Dam 20		Carp Channel catfish	
Lock and Dam 24 to Lock and Dam 25		Channel catfish	
Illinois River Confluence to Alton, Ill.		Channel catfish Carp	
Jefferson Barracks Bridge to Ft. Chartres, Ill.			Carp Channel catfish
Ft. Chartres to Cairo, Ill.		Carp Channel catfish	
Lock and Dam 22 to Cairo			Shovelnose sturgeon and sturgeon eggs

Group 1: Lowest level of contaminants
Group 2: Moderate levels of contaminants; **children, pregnant women, women who may become pregnant and nursing mothers should not eat Group 2 fish;** all others should limit their consumption of these fish to one meal per week.
Group 3: High levels of contaminants; **no one should eat Group 3 fish.**

Questions about the
taminant Monitoring

What chemicals are tested?

The thirteen commercial pestic
lubricants listed in the following table
program. These products are manu
and chlorine and are classified as or
pounds. Chlordane, heptachlor, aldr
the same components but their circu
ture further identifies them as cyclod
aid in the identification of new source
tential contamination, some whole fi
analyzed for about 50 additional che

Why were they selected?

The environmental toxicants list
selected for the routine fish tissue te
cause they are widely dispersed in t
are persistent and common. Over t
these compounds have been cance
stricted by the U.S. EPA; however, t
the environment over long periods o
solubility in water have resulted in c
aquatic food chain.

How are fish tested for contamin

A state fish contaminant monito
been established. IDOC biologists s
species from designated areas in th
samples are carefully prepared and
to the IEPA laboratories for testing.

The U.S. Food and Drug Admin
standard used in this program calls
portion of the fish. The tissue samp
boneless, scaleless skin on the fillet
fish. (Catfish and bloater chubs are
dard testing protocol using gas chro
ures the samples for contamination.

The laboratory results are then
USFDA tolerance levels and are us
whether to issue a health advisory.

How are tolerance levels determi

The USFDA has established ac
chemical residues in fish called leve

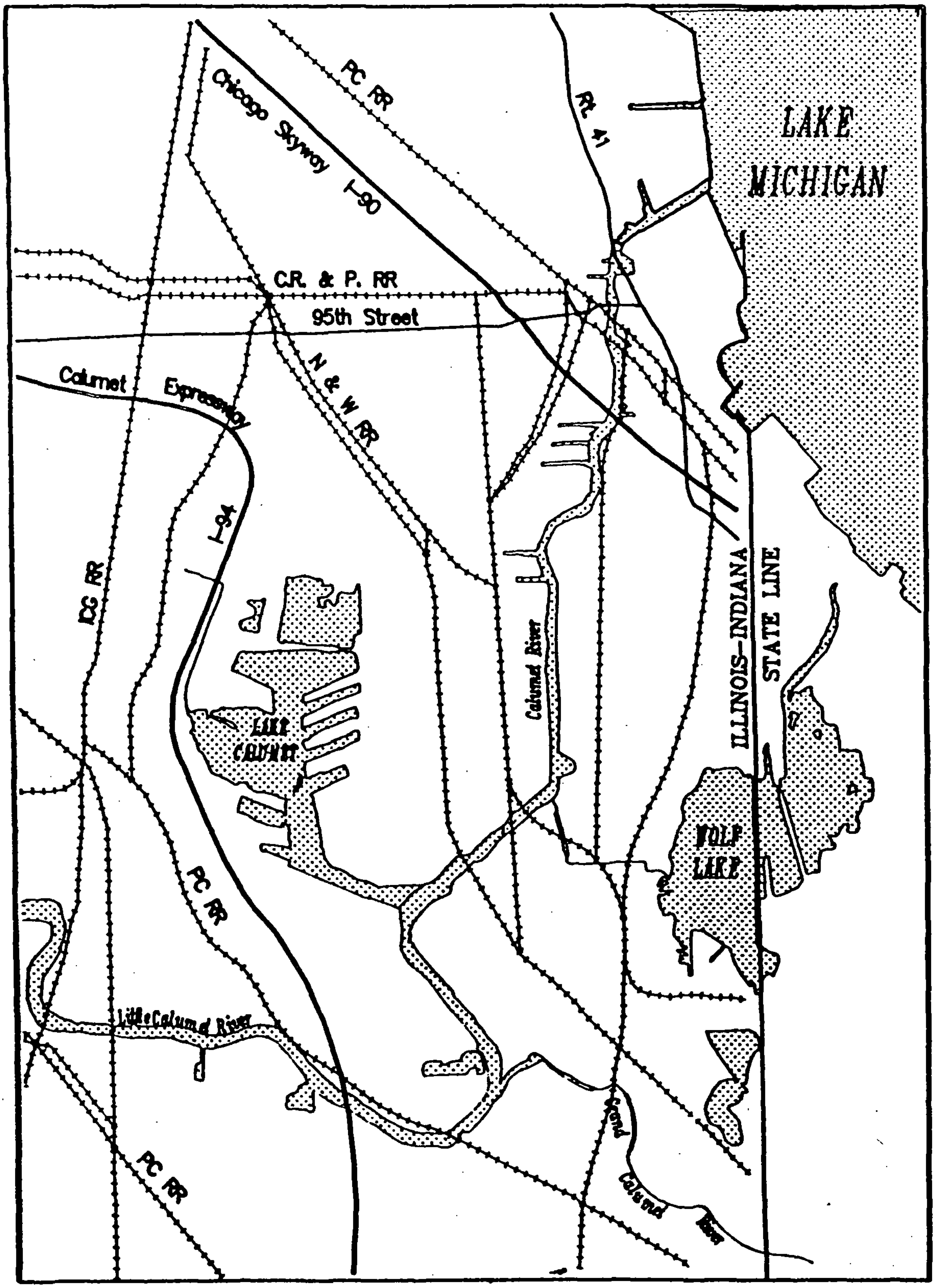


Figure 1. General Lake Calumet study area

UNIT 1

Chiefly glaciolacustrine

Qlsr

SAND, fine to medium, locally coarse, pebbly, and organically rich. Forms beach ridges and dunes that represent former strand lines. Includes manmade land along edge of Lake Michigan.

Qlsp

SAND, fine to medium, silty, or clayey, locally organically rich. Forms relatively flat to slightly rolling plains between sand dunes and beach ridges.

Qlcs

CLAY, silty, maroon, alternating with layers of tan silt; thinly laminated. Locally contains calcareous concretions and some sand.

UNIT 2

Qlvm

TILL; silty clay, generally buff to tan in outcrop, somewhat sandy and pebbly. Forms upper part of the dissected ground moraine (hatched pattern) and the terminal moraines of the Valparaiso morainal system.

UNIT 3

Chiefly glaciofluvial

Qgs

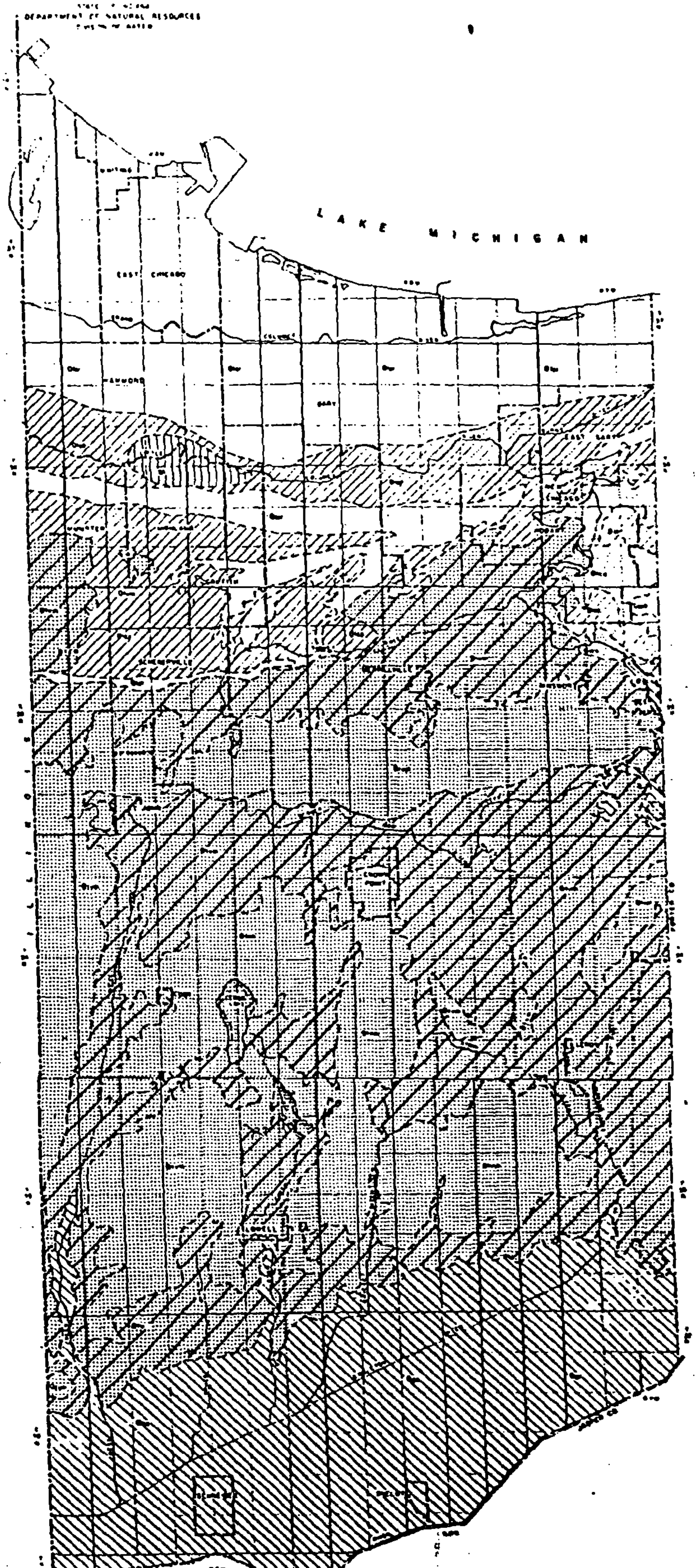
SAND, fine to coarse, somewhat silty, clayey, and organically rich. Locally interbedded with layers of organically rich silt and clay of relatively small areal extent. Contains small sand dunes.

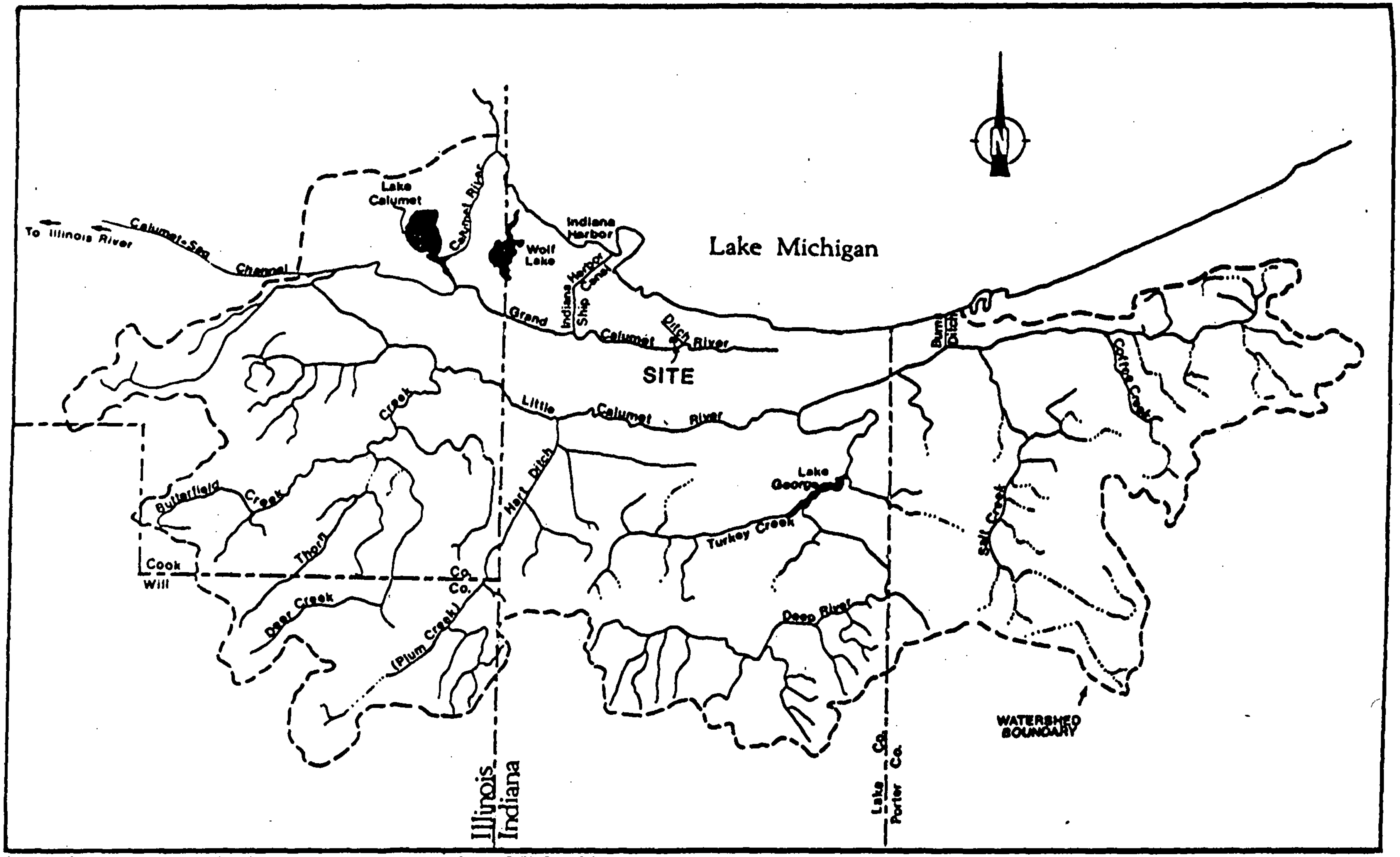
UNIT 4

Qtl

TILL; hard, compact, gray clay with subangular to rounded pebbles.

Approximate contact, queried where less accurate



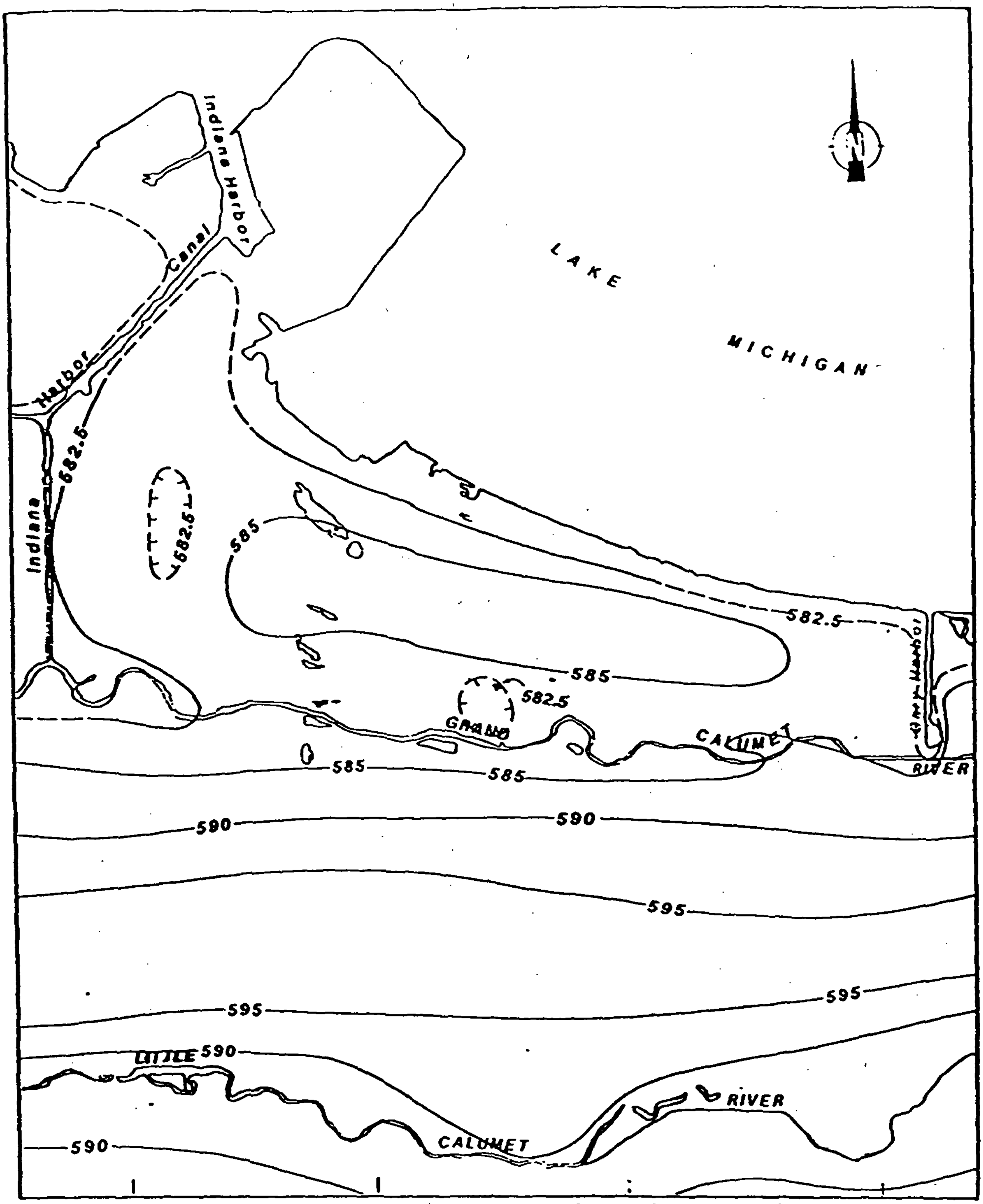


SOURCE: Ecology and Environment, Inc. 1990, after IDENR, 1988.

SCALE

0 5 10 15 20 MILES

FIGURE 2-4 SURFACE WATER IN THE VICINITY OF THE STUDY AREA



SOURCE: USGS, Lee Watson, et al, Preliminary Analysis of the Shallow Ground-water System in the Vicinity of the Grand Calumet River/Indiana Harbor Canal, Northwestern Indiana, 1989.

FIGURE 4-3 REGIONAL GROUNDWATER ELEVATIONS IN THE VICINITY OF THE STUDY AREA

SYSTEM	SERIES	GROUP OR FORMATION	HYDROLOGIC UNITS	LOG	THICKNESS (FT.)	DESCRIPTION
Quaternary	Pleistocene		Glacial drift aquifers		0-100+	Unconsolidated glacial deposits - pebbly clay (till), silt, and gravel. Alluvial silts and sands along streams.
Pennsylvanian		Carbondale Tradewater			Absent	Shale; sandstones, fine-grained; limestones; coal; clay.
Mississippian	Kinderhook				Absent	Shale, green and brown, dolomitic; dolomite, silty.
Devonian					Absent	Shale, calcareous; limestone beds, thin.
Silurian	Niagaran	Port Byron Racine Waukesha Joliet	Silurian (Shallow dolomite aquifer)		0-465	Dolomite, silty at base, locally cherty.
	Alexandrian	Kankakee Edgewood				
Ordovician	Cincinnatian	Maquoketa	Maquoketa (Shallow dolomite aquifer)		0-250	Shale, gray or brown; locally dolomite and/or limestone, argillaceous.
	Mohawkian	Galena	Galena-Platteville (Cambrian-Ordovician Aquifer)		220-350+	Dolomite and/or limestone, cherty.
		Decorah				Dolomite, shale partings, speckled.
		Platteville				Dolomite and/or limestone, cherty, sandy at base.
		Glenwood	Glenwood-St. Peter		100-650	Sandstone, fine- and coarse-grained; little dolomite; shale at top.
	Chazyan	St. Peter				Sandstone, fine- to medium-grained; locally cherty red shale at base.
	Prairie du Chien	Shakopee	Prairie du Chien		0-340	Dolomite, sandy, cherty (oolitic); sandstone.
		New Richmond				Sandstone, interbedded with dolomite.
		Oneota				Dolomite, white to pink, coarse-grained, cherty (oolitic), sandy at base.
Cambrian	St. Croixan	Trempealeau	Trempealeau		0-225	Dolomite, white, fine-grained, geodic quartz, sandy at base.
		Franconia	Franconia		45-175	Dolomite, sandstone, and shale, glauconitic, green to red, micaceous.
		Ironton	Ironton-Galesville		105-270	Sandstone, fine- to medium-grained, well sorted, upper part dolomitic.
		Galesville				
		Eau Claire	Eau Claire (upper and middle beds)		235-450	Shale and siltstone, dolomitic, glauconitic; sandstone, dolomitic, glauconitic.
		Mt. Simon	Sandstones Eau Claire (lower) & Mt. Simon (Mt. Simon)		2000±	Sandstone, coarse-grained, white, red in lower half; lenses of shale and siltstone, red, micaceous.
Precambrian crystalline rocks						

Figure 3. Stratigraphic column for the Lake Calumet region (modified from Suter et al., 1959)

Reference 14

Environmental - Regulatory

Review

Grand Calumet River

and

Indiana Harbor Canal

Great Lakes National Program Office
U.S. Environmental Protection Agency
536 South Clark Street
Chicago, Illinois

October 1982

Table of Contents

List of Tables

List of Figures

I Introduction

The State of Indiana and the United States Environmental Protection Agency (USEPA) both agree that additional concerted state-federal effort is needed to improve Grand Calumet River-Indiana Harbor Canal (GCR-IHC) water quality to the point where multiple uses could be sustained. Toward that goal, the State-USEPA Agreement has highlighted northwest Indiana as the area where extensive state pollution control resources should be concentrated. As a preliminary step, the subject review was prepared to better define the remaining ecological problems within the GCR-IHC system. Because of the complexity of this system - both hydraulic and pollutional - this assessment deals with the GCR-IHC alone. It does not consider GCR-IHC effects upon southern Lake Michigan, to which the GCR-IHC discharges.

II Background

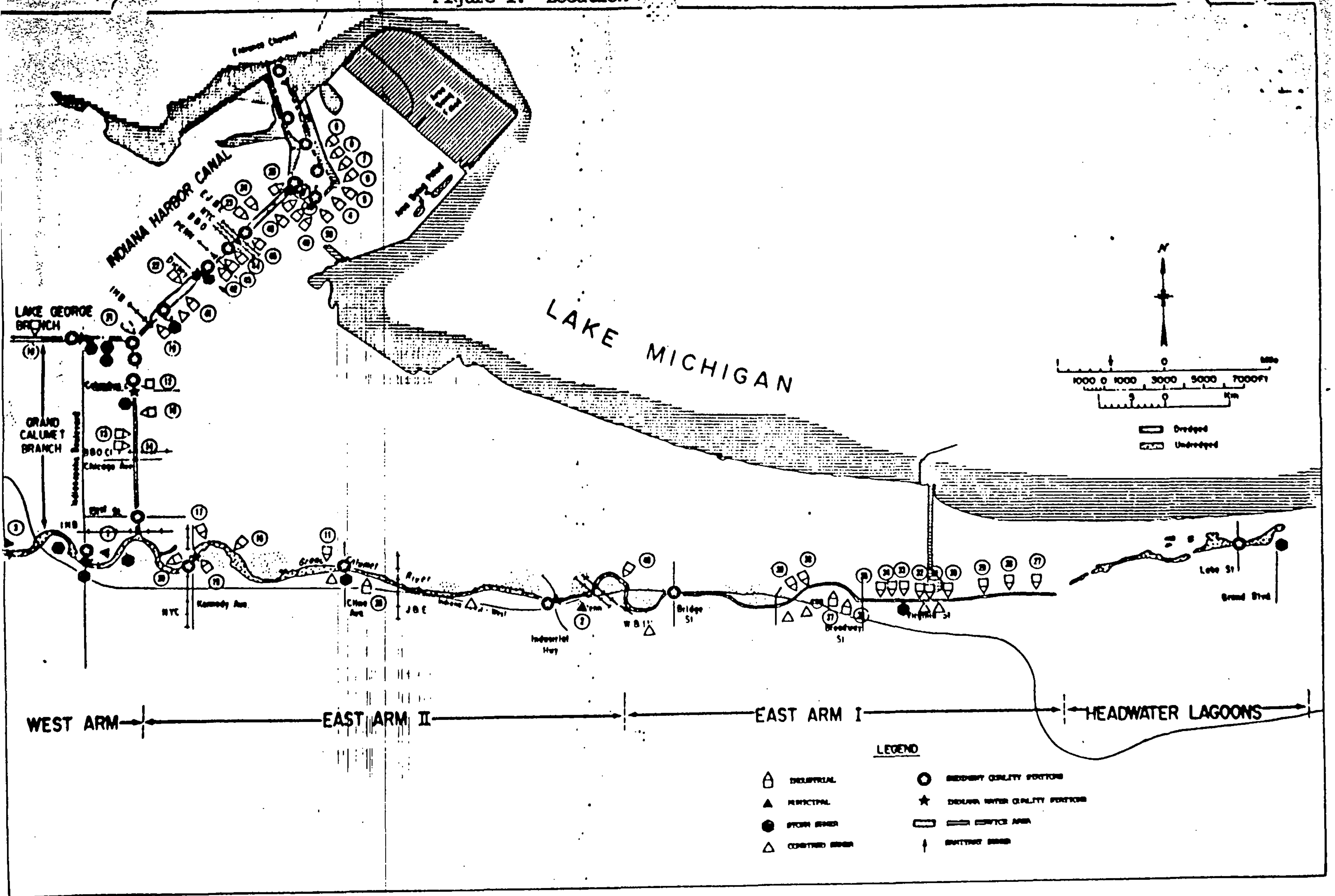
The Grand Calumet River Basin is located in the northwest corner of Indiana and the adjacent area of Illinois. The basin is contained almost wholly within Lake County encompassing approximately 43,242 acres. The Little Calumet River borders to the south while Lake Michigan lies to the north.

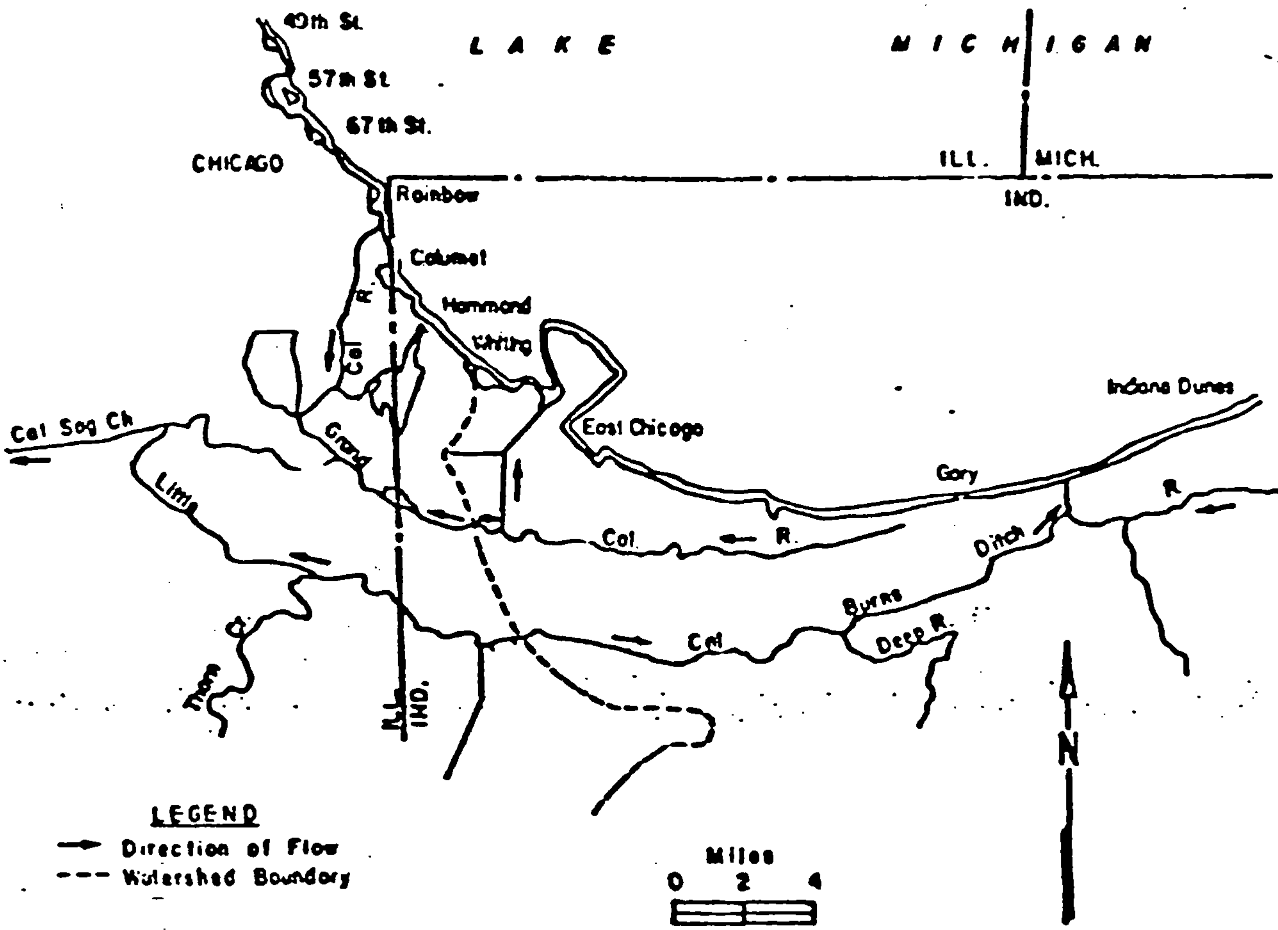
The Grand Calumet River (GCR) originates near a series of lagoons west of Marquette Park (Fig. 1). At one time these lagoons were the rivermouth, but diversion of river waters at the Cal-Sag Canal and Indiana Harbor Canal (IHC) has greatly reduced the flow. Eventually the mouth of the river was closed by drifing sand and aquatic vegetation. Presently the GCR is 13 river miles long (westward flow), being joined by the IHC three miles east of the Illinois border. Waters entering the IHC flow about five miles to the north and then northeast, exiting into southern Lake Michigan.

The topography of the Basin is flat and the river is shallow with the bottom covered with a mixture of organic debris, mud, and sludge. Due to man-made alterations to the stream channel, the flow pattern of the Grand Calumet River and the Indiana Harbor Canal (a man-made channel which connects the GCR to Lake Michigan) is quite complex. The east branch of the GCR flows westward to the IHC which flows northward to the Lake. The west branch of the GCR, however, is divided into two segments which are normally separated by a natural divide located near the east edge of the Hammond municipal wastewater treatment plant. Water in the east segment of the west branch joins the east branch of the river to form the IHC. Water in the west segment of the west branch on the other hand, occasionally flows westward into Illinois the result of weather conditions on Lake Michigan.

The IHC normally flows to Lake Michigan because of the great rate at which lake water is pumped into the canal via the Grand Calumet River by the U.S. Steel-Gary Works. However, the canal's flow may reverse itself for short periods of time, according to the stage of Lake Michigan. Figure 2 illustrates the stream flow patterns of the Grand and Little Calumet Rivers. Since no U.S.G.S. gaging stations are located within the Grand Calumet Basin, no information is available regarding the maximum and minimum flows of the GCR.

Figure 1: Location Map





STREAM FLOW PATTERNS OF THE
GRAND AND LITTLE CALUMET RIVERS

The backwater or estuary effect on the GCR-IHC caused by the varying Lake Michigan water levels makes a river stage-discharge relationship - the relationship measured at a gaging station - impossible to define. An additional gage to compensate for the backwater effect would produce results that could be as much as 50 percent in error. However, the expense of the multiple gages and the expected unreliability of the data, precludes establishment of a dual system in this area (7). Recent average flows have been estimated (1) and are discussed Page 9.

The major concentrations of population in the Basin are located in and around the cities of East Chicago, Gary, Hammond, and Whiting. Domestic and industrial wastewaters generated from these cities are discharged to the Grand Calumet River. Currently, three (3) municipal and 74 industrial point sources discharge to the Grand Calumet Basin (see Table I). The Hammond and Gary Sanitary District wastewater treatment plants are regional facilities which serve some towns and industries located outside the Grand Calumet River Basin.

The GCR-IHC area has a population of over 500,000 and has one of the most concentrated steel and oil complexes in the nation. In excess of 90 percent of the water flowing in the GCR-IHC system enters as treated wastewater, industrial cooling/process water, and as storm water.

III Water Quality

Of all Indiana streams, the Grand Calumet River and the Indiana Harbor Canal violate all of the State Water Quality Standards (WQS) most frequently. The GCR-IHC water quality standards, which protect for partial body contact, limited aquatic life and industrial water supply are shown as Appendix B. While the water quality